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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/706,033	11/13/2003	Se-Young Jang	1572.1194	6029

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EXAMINER	
BARRECA, NICOLE M	
ART UNIT	**PAPER NUMBER**
1756	

DATE MAILED: 06/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/706,033	Applicant(s) JANG, SE-YOUNG	
	Examiner Nicole M. Barreca	Art Unit 1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 May 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) *7-13* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6 and 14-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *11/13/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Applicant's election with traverse of Group I, claims 1-6 and 14-18 in the reply filed on 5/5/03 is acknowledged. The traversal is on the ground(s) that there have been no references cited to show any necessity for requiring restriction. This is not found persuasive because the examiner is not required to cited references in a restriction requirement. As stated by the applicant, MPEP 803 sets forth the criteria for restriction between patentably distinct inventions. (A) indicates that inventions must be independent or distinct as claimed. As stated in the previous restriction requirement, Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by another and materially different process, such as an additive process of selective deposition of the UBM layer (instead of a subtractive process using etching).

2. The applicant also argues that the examiner has not set forth why there would be a serious burden if restriction is not required, criteria (B). This is not found persuasive because the inventions of Groups I and II are distinct and have acquired a separate status in the art, as shown by their different classification and because of their divergent subject matter. The search required for Group II is not required for Group I. The claims of Group II, are not limited by process limitations and therefore the under bump metallization may be made by any process, such as selective deposition. The claims of

Group I require making the UBM using photolithography and etching. In addition each individual search encompasses not only the subclass that the invention is classified in, but also numerous other subclasses.

The requirement is still deemed proper and is therefore made FINAL.

3. Claims 7-13 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 5/5/05.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> ((e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 5, 6, 15-17 are rejected under 35 U.S.C. 102(e) as being anticipated by Datta (US 6,750,133).

6. Semiconductor structure 10 includes substrate 12 and metallization 14 such as a copper pad. Nitride layer 18 and passivation layer 20 are formed over substrate 12, corresponding to protective layers (col.2, 47-65, Fig.1). First metal layer 26 and second metal layer 28 are formed, corresponding to UBM (Fig.3,4). The first metal layer may be Ti, Cr and Ti W, while the second metal layer may be Cu (col.3, 26-col.4,

23). Figure 5 illustrates second mask 30, formed of a photoresist material. Copper stud 34 is plated over the first and second metal layers to a thickness of about 5 to about 15 microns (col.4, 30-59, Fig.6). Bump precursor 36 is plated over copper stud 34 through the second mask 30. The bump precursor may be a lead-free solder according to various lead-free solders as are known in the art (col.5, 14-50, Fig.7). The second mask 30 is removed and an etch process is performed to remove second metal layer 28 using the bump precursor and metal stud as a mask (col.5, 51-63, Fig.8,9). An etch process is performed to remove first metal layer 26 using the bump precursor and metal stud as a mask (col.6, 44-50, Fig.10). The bump precursor is reflowed to form a solder ball 37 (col.7, 18-29, Fig.11). See also col.8, 10-32.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Datta as applied to claim 1 above, and further in view of Cheung (US 6,638,847).

9. Datta teaches the solder bump may be a lead-free solder according to various lead-free solders as are known in the art but is silent on the specific material used for the solder bump and does not disclose the solder comprises tin or comprises tin and silver. Cheung teaches a method for forming lead free bump interconnections. Pure tin or tin alloys can be directly substituted for conventional lead-tin alloys, as such solders

are considered more environmentally friendly than those including lead. Tin based solders can be formed to give well defined, regular bumps and are compatible with existing reflow processes and materials and with surface mount equipment and techniques. Examples of a tin alloy include tin-silver and tin-silver-copper (col.2, 8-col.3, 57). It would have been obvious to one of ordinary skill in the art to use tin or tin alloys such as tin-silver and tin-silver-copper for the lead-free solder in the method of Datta because Cheung teaches that such solder materials can be formed to give well defined, regular bumps, are compatible with existing reflow processes and materials and are preferred over conventional solders because of the environmental problems associated with lead.

10. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Datta as applied to claim 1 above, and further in view of Darbha (US 5,904,555).

11. Datta teaches reflowing the solder but is silent on the specific reflow conditions and does not disclose performing the reflow for about 1 to about 20 minutes at a temperature of about 220 °C to about 270 °C. Darbha teaches that the time and temperature of a reflow process are generally determined according to the type of device being formed and the composition of the solder bumps (col.5, 11-26), thereby establishing the time and temperature of a solder reflow as result effective variables. It would within the ordinary skill of one in the art to determine the time and temperature of the solder reflow in the method Datta by routine experimentation and to perform the reflow for about 1 to about 20 minutes at a temperature of about 220 °C to about 270 °C, if required, because the solder reflow time and temperature are a result-effective

variables, as taught by Darbha and the discovery of an optimum value of a result effective variable is ordinary within the skill of the art, as taught by *In re Boesch*, (617 F.2d 272, 205 USPQ 215 (CCPA 1980)).

12. Claims 14 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Datta as applied to claims 1 or 16 above, and further in view of Leibovitz (US 6,146,984).

13. Datta teaches reflowing after the etching of the UBM layer using the solder as a mask and does not exemplify the reverse. Leibovitz teaches a method for forming solder bumps wherein the UBM layer is etched using the solder material as a mask, after the removal of the photoresist layer. The selective etching of the UBM may be performed before or after the solder reflow (col.5, 17-27). It would have been obvious to one of ordinary skill in the art to perform the selective etching of the UBM layer after reflowing the solder in the method of Datta, instead of before, because Leibovitz teaches that the selective etching of the UBM may be performed either before or after the solder reflow.

Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicole M. Barreca whose telephone number is 571-272-1379. The examiner can normally be reached on Monday-Thursday (9AM-7PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nicole M Barreca
Primary Examiner
Art Unit 1756

6/23/05